UNITED STATES DEPARTMENT OF AGRICULTURE
Office of Marketing Services
Cotton and Fiber Branch

COTTONSEED QUALITY TEST RESULTS OF INTEREST TO COTTONSEED OIL MILL SUPERINTENDENTS

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(Presented by the senior author before meeting of Board of Directors, Tri-States Cottonseed Oil Mill Superintendents' Association, Greenville, Miss., August 18, 1945)

The quality of cottonseed as influenced by methods of harvesting, drying, cleaning, and ginning has received consideration in the research programs at the U. S. Cotton Ginning Laboratory for a long time; but during the past year, with the establishment of laboratory facilities for more extensive determinations of cottonseed qualities and their significance in cottonseed grading, the work on cottonseed has been expanded. Much needed basic information has resulted from these studies--information which cottonseed oil mill superintendents are finding of interest and use to them in their efforts to increase the efficiency of oil mill operations. Your President, Mr. C. Y. Katzenmier, has asked us to summarize the findings that can be released in preliminary form for the benefit of the industry. Before doing so, however, we wish to acquaint you with our cottonseed testing laboratory facilities and discuss briefly our cottonseed standardization and marketing research program and the objectives of the work involved in this program and in cottonseed testing activities incident to other programs at the Stoneville Laboratory.

Facilities have been provided for making determinations of oil, nitrogen, free fatty acid, moisture, foreign matter, and residual lint contents by standard laboratory methods, as well as for experimentally determining moisture content by rapid electrical and hygrometric procedures as possible alternative methods for the customary oven-test methods. A Laboratory model delinter has also been provided for mechanically delinting cottonseed, thus making linters and delinted seed available for the studies under way. Other alternative procedures for rapidly indicating important cottonseed quality elements are under development in the laboratory.

The principal objectives of the cottonseed research and testing work at Stoneville are as follows:

(1) To develop information, methods, and equipment needed for quickly evaluating the quality of cottonseed at the gin. By making grade determinations of individual lots of cottonseed at gins, growers would have a greater incentive to produce high-quality cottonseed. If individual growers were more generally paid for cottonseed on the basis of its grade, serious consideration would be given to seed in determining the variety of cotton most profitable for production. Also, more care would be exercised in harvesting and handling the seed cotton in a manner conducive to cottonseed quality preservation and improvement, just as is being done to improve the value of lint cotton.

(2) To provide information to serve as a scientific basis for improving the official standards for cottonseed and for indicating any needed adjustments in such standards.

(3) To measure the quality of cottonseed as affected by different methods of cotton harvesting, handling, drying, cleaning, and ginning. The greatly expanded cooperative mechanization studies of the U. S. Cotton Ginning Laboratory and the Delta Experiment Station have emphasized the importance of taking cottonseed quality into consideration in evaluating cotton production, harvesting, and ginning processes. These processes are being investigated with a view of developing methods for reducing the cost of producing, handling, and marketing cotton.

Although this project has been under way only a short time, some progress already has been made in the development of methods for quickly determining the value of lots of cottonseed ginned from wagon or truckloads of cotton at gins. The work this year has definitely brought out the fact that this field of research offers promising possibilities. Complete analyses were made of cottonseed samples representing a wide range of varieties, growth conditions, cultural practices, and foreign matter and moisture contents, different stages of harvest and degrees of field deterioration, and various methods of drying, cleaning, and storage--all with a view of providing basic information needed in the development of a gin grading system.

Oil mill superintendents know that the variety of cotton affects the oil content and other properties of cottonseed. They also know that weather and cultural conditions during the various stages of development of the cotton plant, together with weather conditions during the harvesting season and practices employed during cotton harvesting, are important factors in determining the milling qualities of the seed.

The results of tests made at the Stoneville Laboratory 1/ show that the variety of cotton is one of the most important single factors affecting the oil content and value of cottonseed, just as it is an important factor influencing the spinning value of the lint. The oil content is an inherent characteristic of cotton varieties but it can be influenced by growth conditions. The effects of growth conditions, however, are similar for different varieties. In tests made on cottonseed ginned from 12 varieties grown at 6 locations in the Delta, it was found that varieties generally showed the same relationship to one another with respect to oil content, irrespective of the place of growth (table 1). The Delfos strains were generally high in oil content, with the Bobshaw and Stoneville strains near the top, and such varieties as Deltapine, Coker, and Wilds following. The average oil content for all locations ranged from 17.6 to 20.5 percent, or showed an average range of about 3 percent for the different varieties. When all varieties were averaged for each location, the range in oil content was only 1.8 percent, with the Kelso location showing the high and Heathman the low percentage. The difference in oil content of about 3 percent due to the varietal influence will cause a variation in oil extraction of almost 8 gallons per ton of cottonseed. For all varieties and test locations, the lowest oil-content seed was Coker 100-8 grown at Heathman, while the highest was Delfos 531C seed at Kelso, the range from the lowest to the highest oil being from 16.5 to 21.6 percent. The variety influence in this range was greater than the location effect. The three high oil-content locations were Kelso, Stoneville, and Tunica, followed by Valley Hill, Money, and Heathman.

In contrast to the oil-content relationships indicated, the ammonia content of the cottonseed was found to be affected by location to a greater extent than by variety. The average ammonia contents of the different varieties ranged from a high of 4.11 at Money to a low of 3.17 at Kelso, and showed a location difference of 0.94 percent as compared with a difference of 0.34 percent between varieties averaged for all locations (table 2). Even so, ammonia content was characteristic of variety, with some varieties consistently exceeding others in this element of quality at the various test locations. Moreover, the high oil-content varieties did not necessarily show low-ammonia contents. On the average for all locations, the two highest oil-yielding varieties gave about the same average ammonia content as the two lowest oil producers. At Money, which gave the highest average ammonia content--4.11 percent--the four high oil producers--Delfos 531C, Delfos 651, Bobdel, and Stoneville 2B--showed respective percentages of ammonia of 4.14, 4.07, 4.09, and 4.13; and at Kelso, where the lowest average ammonia was found to be 3.17 percent, the high-oil-content varieties had ammonia contents of 3.09, 3.15, 3.18, and 3.25 percent, respectively. For a given variety grown at different locations, there was a definite tendency for ammonia content to decrease with an increase in oil content from one location of growth to another.

1/ In cooperation with the Delta Experiment Station.

Table 1. - Oil content of cottonseed as affected by variety and place of growth, Yazoo-Mississippi Delta, 1944

Variety	Place of growth						
	Stoneville	Heathman	Money	Kelso	Tunica	Valley Hill	All locations
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Delfos 531C	21.1	19.3	20.3	21.6	20.9	19.8	20.5
Delfos 651	20.9	19.2	20.0	21.4	20.3	20.5	20.4
Bobdel	20.4	19.0	19.5	20.4	20.2	20.1	19.9
Stoneville 2B	20.0	18.6	18.9	20.0	19.7	19.5	19.5
Delfos 444	20.0	18.7	19.8	20.0	19.9	19.5	19.7
Bobshaw 1	19.9	18.2	18.9	20.3	19.8	19.1	19.4
Stoneville 2C	19.9	18.3	18.8	19.8	19.4	19.2	19.2
Miller	19.1	17.9	18.3	19.5	18.2	17.9	18.5
Deltapine 14	19.0	17.8	18.2	19.2	18.1	19.0	18.6
Rowden (Roldo)	18.4	17.2	17.2	19.2	17.2	17.2	17.7
Wilds 16	18.2	17.6	18.7	19.8	19.4	18.9	18.8
Coker 100-8	18.0	16.5	17.5	18.3	17.7	17.4	17.6
All varieties	19.6	18.2	18.8	20.0	19.2	19.0	19.1

Oil content calculated to 12 percent moisture of cottonseed.

Table 2. - Ammonia content of cottonseed as affected by variety and place of growth, Yazoo-Mississippi Delta, 1944

Variety	Place of growth						
	Stoneville	Heathman	Money	Kelso	Tunica	Valley Hill	All locations
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Delfos 531C	3.49	4.16	4.14	3.09	3.73	3.66	3.71
Delfos 651	3.54	4.10	4.07	3.15	3.76	3.65	3.71
Bobdel	3.51	4.13	4.09	3.18	3.78	3.67	3.73
Stoneville 2B	3.42	4.01	4.13	3.25	3.78	3.67	3.71
Delfos 444	3.30	3.91	3.96	2.94	3.54	3.38	3.51
Bobshaw 1	3.53	4.08	4.04	3.14	3.56	3.66	3.67
Stoneville 2C	3.48	4.00	4.11	3.15	3.66	3.76	3.69
Miller	3.52	3.98	4.18	3.12	3.92	3.84	3.76
Deltapine 14	3.67	4.15	4.17	3.33	3.93	3.73	3.83
Rowden (Roldo)	3.54	4.08	4.05	3.16	3.75	3.84	3.74
Wilds 16	3.55	4.10	4.23	3.39	3.90	3.92	3.85
Coker 100-8	3.57	4.02	4.13	3.13	3.75	3.64	3.71
All varieties	3.51	4.06	4.11	3.17	3.76	3.70	3.72

Ammonia content calculated to 12 percent moisture content of cottonseed.

To an oil miller, the residual-lint content of cottonseed is of importance not only because it definitely influences the amount of lint that can be cut from the seed, but because it has a bearing in many instances on the oil yield of a ton of seed. Here again the variety of cotton exerts much more influence than the place of growth. On the average, for all locations, the residual lint varied from 11 percent for Deltapine to 17.8 percent for Rowden, and showed a range of 6.8 percent, or 136 pounds of lint per ton of cottonseed (table 3). On the other hand, the greatest variation between locations for all varieties was only 3.6 percent, or 72 pounds of lint per ton. Money produced the lowest average residual-lint content, 10.9 percent; and Kelso the highest, 14.5 percent. The maximum difference between varieties for a given location was 7.9 percent at Stoneville, where Deltapine 14 had a residual-lint content of 10.3 and Rowden of 18.2 percent. The largest difference between locations was 4.7 percent with Delfos 444. There was a tendency toward an inverse relationship between oil content and residual-lint content of different varieties of cottonseed, the exceptions apparently being Deltapine 14 and Wilds. Both were low in residual-lint content but slightly below average in oil content. For a given variety of cotton, however, the relationship between oil content and residual-lint content was not consistent for the different places of growth.

In evaluating the cottonseed representing the 12 varieties grown at the 6 locations, the oil content proved to be the most important factor affecting the grade of the cottonseed (table 4). The average grade for all locations varied from 97.5 for Coker 100-8 to 109.0 for Delfos 531C and Delfos 651. On the other hand, the maximum average difference between places of growth for all varieties was only 3 points. In monetary terms, variety showed value difference per ton as high as about $6; and place of growth, only $2 for all varieties (table 5).

While the variety of cotton has a definite influence on the oil content and value of the cottonseed, the varieties producing high money value on cottonseed are not necessarily those varieties yielding the highest money value of lint and cottonseed per acre. The yield of the cotton fiber or lint per acre is a very important consideration in determining the most profitable variety of cotton for planting. For example, the Delfos varieties showed up well in seed value, but when other factors such as lint yield were considered in determining the total money value of the cottonseed and lint produced for the different varieties, the Delfos strains were not among the high-ranking varieties so far as monetary returns per acre were concerned. In some cases, however, the cottonseed oil returns helped some varieties rank high in money value per acre, particularly Stoneville 2B. For all locations in the Yazoo-Mississippi Delta last season, the Delta Experiment Station reported, "When the money value data from the seven tests were analyzed in the combined analysis, it was found that Stoneville 2B, Deltapine 14, and Bobshaw 1 were leading money value producers." 2/

The influence of variety on the oil content of cottonseed was so noticeable and significant that the possibilities for increasing the oil content of cottonseed through breeding and selection were explored at Stoneville last year. Complete analyses were made of cottonseed samples representing new strains and parent strains grown in test plots of the Delta Experiment Station. For a high-oil-content variety, no new selection or strain tested higher than the parent, while in a low-oil-content variety, most of the new strains significantly exceeded the parent in oil content of cottonseed, in one case the difference causing a value increase of $2 per ton of cottonseed (table 6). These data indicate promising possibilities for the breeder improving through selection the oil content of seed varieties deficient in this property.

2/ Cotton Variety Tests in the Yazoo-Mississippi Delta by J. Winston Neely and Sidney G. Brain, Mississippi Agricultural Experiment Station. Bul. 416.

Table 3. - Residual-lint content of cottonseed as affected by variety and place of growth, Yazoo-Mississippi Delta, 1944

Variety	Place of growth						
	Stoneville	Heathman	Money	Kelso	Tunica	Valley Hill	All locations
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Delfos 531C	11.5	11.5	9.5	12.6	12.6	12.4	11.7
Delfos 651	10.5	11.7	9.4	13.1	12.2	12.0	11.5
Bobdel	10.7	11.6	9.2	12.8	12.6	12.3	11.5
Stoneville 2B	11.7	12.2	10.0	13.3	12.3	12.2	12.0
Delfos 444	13.5	14.4	11.2	15.9	14.5	14.9	14.1
Bobshaw 1	11.8	13.0	10.3	13.6	13.1	12.7	12.4
Stoneville 2C	12.2	14.1	10.7	14.9	13.5	13.0	13.1
Miller	16.0	16.9	14.1	17.3	16.4	15.8	16.1
Deltapine 14	10.3	10.8	9.0	12.2	12.2	11.7	11.0
Rowden (Roldo)	18.2	18.0	15.1	18.8	19.0	17.5	17.8
Wilds 16	11.2	12.8	10.0	12.9	12.5	11.5	11.8
Coker 100-8	14.0	15.7	12.1	16.4	15.4	15.9	14.9
All varieties	12.6	13.6	10.9	14.5	13.9	13.5	13.2

Table 4. - Grade of cottonseed as affected by variety and place of growth, Yazoo-Mississippi Delta, 1944

Variety	Place of growth						
	Stoneville	Heathman	Money	Kelso	Tunica	Valley Hill	All locations
	Index	Index	Index	Index	Index	Index	Index
Delfos 531C	110.5	107.0	111.0	110.0	111.0	106.0	109.0
Delfos 651	110.0	106.5	109.5	109.5	109.0	109.0	109.0
Bobdel	107.5	106.0	107.5	105.5	108.5	107.5	107.0
Stoneville 2B	105.5	103.5	105.5	104.5	106.5	105.0	105.0
Delfos 444	105.0	103.5	108.0	102.5	106.0	103.5	105.0
Bobshaw 1	106.0	102.5	105.0	105.0	105.5	103.5	104.5
Stoneville 2C	105.5	102.0	105.0	103.0	104.5	104.5	104.0
Miller	102.5	100.5	103.5	101.5	101.5	99.5	101.5
Deltapine 14	103.0	101.0	103.0	102.0	101.0	103.5	102.5
Rowden (Roldo)	100.0	98.5	98.0	101.0	96.5	97.0	98.5
Wilds 16	99.0	100.0	105.0	104.5	106.0	104.0	103.0
Coker 100-8	98.5	94.5	100.0	97.0	98.5	96.5	97.5
All varieties	104.5	102.0	105.0	104.0	104.5	103.0	104.0

Table 5. - Value of cottonseed per ton 1/ as affected by variety and place of growth, Yazoo-Mississippi Delta, 1944

Variety	Place of growth						
	Stoneville	Heathman	Money	Kelso	Tunica	Valley Hill	All locations
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Delfos 531C	61.88	59.92	62.16	61.60	62.16	59.36	61.18
Delfos 651	61.60	59.64	61.32	61.32	61.04	61.04	60.99
Bobdel	60.20	59.36	60.20	59.08	60.76	60.20	59.97
Stoneville 2B	59.08	57.96	59.08	58.52	59.64	58.80	58.85
Delfos 444	58.80	57.96	60.48	57.40	59.36	57.96	58.66
Bobshaw 1	59.36	57.40	58.80	58.80	59.08	57.96	58.57
Stoneville 2C	59.08	57.12	58.80	57.68	58.52	53.52	58.29
Miller	57.40	56.28	57.96	56.84	56.34	55.72	56.76
Deltapine 14	57.68	56.56	57.68	57.12	56.56	57.96	57.26
Rowden (Roldo)	56.00	55.16	54.88	56.56	54.04	54.32	55.16
Wilds 16	55.44	56.00	58.80	53.52	59.36	58.24	57.73
Coker 100-8	55.16	52.92	56.00	54.32	55.16	54.04	54.60
All varieties	58.52	57.12	58.80	58.24	5 .52	57.68	58.15

1/ Value of seed $56.00 per ton basis grade 100.

Table 6. - Oil content of cottonseed representing the parent and new selections or strains for high- and low-oil-content varieties

Strain	Ammonia content 1/	Oil content 1/	Grade	Value per ton
High oil-content parent variety and new strains				
	Percent	Percent		Dollars
Delfos 6102				
Delfos 531C (old)	3.56	20.9	110.0	61.60
Delfos 531C (8303)	3.52	20.7	109.0	61.04
Delfos 531-0201	3.44	19.6	104.0	58.24
Delfos 531-824	3.65	19.8	106.0	59.36
Delfos 531-1132	3.62	21.0	110.5	61.88
Delfos 531-9169	3.43	20.8	109.0	61.04
Delfos 651	3.61	20.5	108.5	60.76
Delfos 651-050	3.41	20.5	107.5	60.20
Delfos 651-42-43	3.46	20.9	109.5	61.32
Delfos 651-42-51	3.51	21.0	110.0	61.60
Delfos 651-42-72	3.45	19.2	102.5	57.40
Delfos 651-4219	3.38	20.4	107.0	59.92
Delfos 651-4237	3.58	20.7	109.5	61.32
Delfos 9431	3.45	20.7	108.5	60.76
Delfos 9431-4312	3.40	20.7	108.0	60.48
Delfos 9431-4313	3.50	20.1	106.5	59.64
Low oil-content parent variety and new strains				
Coker 100				
Coker 100-8	3.82	17.2	96.5	54.04
Coker 100 Staple Strain 1	3.73	18.4	100.5	56.28
Coker 100-43-1	3.67	18.3	100.0	56.00
Coker 100-4-3	3.70	18.1	99.5	55.72
Coker 100-43-10	3.70	17.7	98.0	54.88
Coker 100-43-27	3.55	17.6	96.5	54.04
Coker 100-43-42	3.56	17.2	95.0	53.20

1/ Ammonia and oil contents calculated to 12 percent moisture content of cottonseed.

Preliminary data accumulated to date indicate that the quality of the lint is not directly related to the oil content of the seed. In fact, some varieties possessing low-oil-content seed are characterized by low spinning value of the lint and others by high spinning value (table 7). Several of the varieties rank high in oil content of the cottonseed as well as in spinning value of the lint, notably Bobdel. Breeders, therefore, are enthusiastic over the opportunity they have for increasing the oil content of cottonseed without sacrificing spinning quality of the lint.

Other studies under way at Stoneville in which oil mill superintendents are showing an interest include the work on cottonseed drying and storage and tests on cottonseed representing different methods of harvesting, defoliation, etc. High-moisture-content seed have always and will, no doubt, continue to be a problem at mills unless means for drying seed at gins are provided.

The increased use of cotton driers at gins for drying green, damp, or wet seed cotton should be a favorable factor in coping with the problem of excess moisture in cottonseed. While the seed cotton drier reduces the moisture content of the cottonseed only a fraction of 1 percent, tests made at Stoneville a few years ago definitely showed that with slight reductions made in the moisture content of the wet cottonseed, reductions in temperature of the cottonseed were indicated during storage of the seed 3/. At the time of drying, the dried lots were a few degrees higher in temperature, but, in a few days, natural cooling eliminated most of the differences; and thereafter the seed lots ginned from the undried damp cottons were higher in temperature than those from the dried cottons. In these tests, drying the seed ginned from the damp cotton inhibited, to a great extent, the development of free fatty acids during storage. The seed cotton drying did not retard free fatty-acid development sufficiently to be relied upon for preserving the quality of cottonseed, so work was put under way at the U. S. Cotton Ginning Laboratory for the development of a cottonseed drier for use at gins.

Over a period of years, the design requirements of a gin drier have been determined, and an experimental cleaner-drier has been developed, the use of which has been found to be feasible 4/. The unit comprises a triple-reel drier having a case 16 feet long, by approximately 5 feet wide, by 9 feet, 6 inches high (fig. 1). The seed is preheated and is then fed into the top of the cabinet to a 22-inch diameter drum which revolves at 38 revolutions per minute. This drum has 5/8-inch perforations so that the seed may fall through these perforations while hulls and grabbots are carried on down to the end of the drum and discharged into the dirt conveyor or to be picked up by a hull suction. Enveloping this 22-inch first cylinder is a larger cylinder of 33-inch diameter by 12 feet length, having 3/16-inch perforations and running at only 19 revolutions per minute. The seed is tumbled down through the length of this drum to a funnel where it is discharged to another drum of this type and of equal length, from which the seed is discharged into a vacuum wheel and seed-blow system. All the cylinders slope 5/8-inch per foot, and are made up of No. 18 gage sheet metal with round perforations. Hot air is brought into the casing at one end of the drier and discharged with the dirt and trash at the lower opposite end. There are no spiders nor hubs within the drums, but channel tracks on the outside of the cylinders are used for both stiffening and for rolling the cylinders.

3/ Effects of Artificially Drying Seed Cotton on Certain Quality Elements of Cottonseed in Storage, by Ralph A. Rusca and Francis L. Gerdes, U. S. Department of Agriculture, Circular 651.

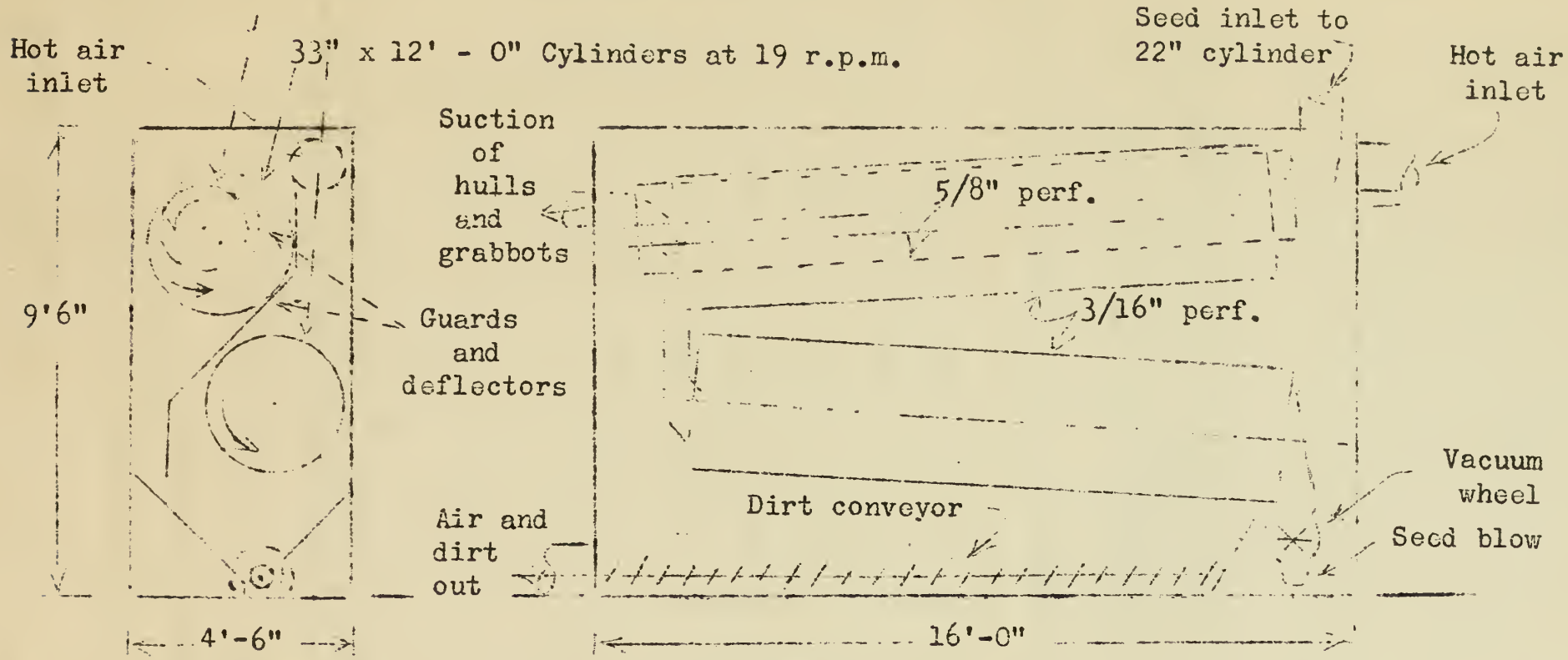
4/ Research and developmental work on cottonseed drying is a part of the program of work of the U. S. Cotton Ginning Laboratory, being conducted jointly by the Cotton and Fiber Branch of the Office of Marketing Services and the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. The accompanying diagram showing the engineering details of the cleaner-drier for cottonseed was supplied by Chas. A. Bennett of the last-named organization.

Table 7. - Quality of cottonseed and lint of different varieties of cotton grown at Stoneville, Miss., 1944

Variety	Cottonseed 1/			Lint 2/		
	Oil content	Ammonia content	Grade	Staple length	Strength of 36s yarn	Appearance grade of 36s yarn
	Percent	Percent	Index	Inches	Pounds	Grade
Bobdel	20.4	3.51	107.5	1-3/32	59	B-
Bobshaw 1	19.9	3.53	106.0	1	54	B+
Coker 100-8	18.0	3.57	98.5	1-1/16	48	B-
Delfos 531C	21.1	3.49	110.5	1-3/32	54	C+
Delfos 651	20.9	3.54	110.0	1-3/32	51	C
Deltapine 14	19.0	3.67	103.0	1-1/16	54	B
Stoneville 2B	20.0	3.42	105.5	1-1/16	55	B
Stoneville 2C	19.9	3.48	105.5	1-1/16	55	B-
Wilds 16	18.2	3.55	99.0	1-9/32	66	C+

1/ From Uniform Variety Tests, Delta Experiment Station.

2/ From Annual Variety Series Tests, Delta Experiment Station. Data from Results of Fiber and Spinning Tests from Some Varieties of Upland Cotton Grown in the United States, Crop 1944. Prepared by the Research and Testing Division, Cotton and Fiber Branch, Office of Marketing Services.



End view in diagram form

Side view in diagram form
All cylinders slope 5/8" per foot

Figure 1. - Engineering details of cottonseed cleaner-drier developed at Stoneville, Miss.

In preliminary tests made on the cottonseed drying unit, it was found that an exposure of cottonseed for 6 minutes to air heated to 175° F. was sufficient to reduce the moisture content enough to retard to a great extent free fatty acid development in cottonseed and to aid in preserving its germination. The moisture content of the wet seed, averaging 17.2 percent, was reduced to 14.1 by passing the seed through the drier three times for an exposure of 6 minutes (table 8). The free fatty acid of the cottonseed dried in this manner averaged only 3 percent at the end of 90 days' storage as compared with 20.9 percent for the undried seed at the end of the storage period.

The experimental unit was found, in early tests on trashy cottonseed, to be fairly effective in cleaning the seed. In tests made on seed ranging in foreign matter from 2.0 to 2.7 percent, the laboratory unit removed about one-third of the foreign matter.

In view of the preliminary results being obtained with the cleaner-drier, it is likely that cottonseed drying facilities will need to be provided at many cotton gins if there continues to be a wide use of rapid methods of harvesting with the accompanying high moisture-content seed cotton. In tests made on cottonseed representing hand-picking and machine-picking methods compared at the Delta Experiment Station last season, it was found that machine picking did not lower the quality of the oil except when an excessive amount of moisture was employed in doffing the spindles of the pickers. The excess moisture caused the seed to heat during storage and to develop free fatty acid rapidly. However, machine picking offers a possibility for preserving the value of cottonseed by making it practicable to hold field damage to a minimum by more timely harvesting of cotton (table 9). This possibility was indicated in a test involving hand and machine picking early in the season and late in the season after prolonged field exposure of the cotton. Early in the season, machine picking increased the moisture content of the seed 2 percent as compared with hand picking. Late in the season, when the seed cotton was lower in moisture content, the machine added only 1 percent moisture to the cottonseed. When machine picking was performed at the same time as hand picking, the free fatty-acid content of the seed representing both methods of picking averaged about the same. Early picking before field exposure gave lower free fatty acid, and higher grade of cottonseed than late picking. Picking early with a machine, therefore, offers some potential benefits in the future from the standpoint of preserving seed quality as compared with delayed harvesting by hand.

By way of summary, it may be said that research work involving the study of the factors affecting the quality of cottonseed, and the development of means for bringing about quality improvements, is very timely now that emphasis is being placed on the need for greater efficiency in cotton production and marketing to improve cotton's competitive position. It is not the price alone which determines the success of the cotton producers but the spread between the production cost and marketing price. Increasing the yield of cotton lint and cottonseed per acre and improving the quality of these products, together with increased mechanization of cotton production, all contribute to the maintenance of a fair margin of profit to the producer. Many of the farm practices, proved by research to be effective in improving the quality of cotton lint, also are helpful in enhancing the value of the cottonseed. The growing movement for planting one variety of cotton over wide areas in an effort to facilitate the marketing of this cotton of improved quality should be a factor in bringing about improvements in quality of cottonseed. The fact that variety definitely is one of the principal factors affecting the spinning value of the lint as well as the milling quality of the cottonseed paves the way toward greater success in the efforts being made to promote standardized production of one-variety cotton. Variety standardization, together with the development of improved ginning facilities for processing mechanically harvested cotton, has also proved to be important from the standpoint of mechanization of cotton production. Thus, it is seen that the importance of variety should gain increased recognition in the development of cotton production and marketing programs in the future.

Table 8. - Effects on moisture content and free fatty-acid content of cottonseed of drying the cottonseed with a drum cleaner-drier developed for use at gins 1/

Method of drying	At the time of drying		After 4 months' storage	
	Moisture content	Free fatty acid content	Moisture content	Free fatty acid content
	Percent	Percent	Percent	Percent
Control lot as ginned	17.2	1.1	19.4	20.9
Undried, but through drier once; no heat	16.8	1.0	17.8	18.8
Undried, but through drier twice; no heat	16.4	1.1	17.9	18.2
Undried, but through drier 3 times; no heat	16.2	1.1	16.7	11.1
Air dried, once through drier; no heat	16.2	1.0	17.8	12.4
Air dried, twice through drier; no heat	15.8	0.9	16.4	9.6
Air dried, 3 times through drier; no heat	15.4	1.0	15.5	6.2
Artificially dried once through drier; heated air 125° F.	15.9	1.0	17.2	11.8
Artificially dried twice through drier; heated air 125° F.	15.2	1.5	15.6	7.7
Artificially dried 3 times through drier; heated air 125° F.	15.0	1.0	14.8	4.8
Artificially dried once through drier; heated air 175° F.	15.6	1.0	16.0	6.6
Artificially dried twice through drier; heated air 175° F.	14.8	0.8	15.0	4.2
Artificially dried 3 times through drier; heated air 175° F.	14.1	0.9	13.9	3.0

1/ Average of 4 series of tests.

Table 9. - Comparative effects of hand- and machine-picked cotton, early and late in the season, on quality of the cottonseed

Picking practice	Oil content 1/	Ammonia content 1/	Free fatty-acid content	Moisture content	Foreign matter content	Grade 1/
	Percent	Percent	Percent	Percent	Percent	Index
Hand-picked before undue field exposure 2/	18.7	3.74	1.3	9.6	0.1	102.0
Machine-picked before undue field exposure 2/	18.5	3.78	1.3	11.7	0.2	101.5
Hand-picked after prolonged field exposure 3/	18.3	3.92	2.9	7.6	0.1	96.0
Machine-picked after prolonged field exposure 3/	18.4	3.80	2.6	8.6	0.4	97.5
Hand-snapped after prolonged field exposure 3/	18.5	3.86	2.6	7.9	0.6	98.0

1/ Adjusted to bases of 12 percent moisture and clean seed.

2/ Harvested on September 22, 1944, when almost 95 percent of cotton was open.

3/ Harvested on December 1, 1944, when all of the cotton was open.